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*Principles of Breeding.* A treatise on thremmatology, or the principles and practises involved in the economic improvement of domesticated animals and plants. By E. DAVENPORT, M.Agr., LL.D., with appendix by H. L. RIETZ, Ph.D. Boston, Ginn & Co. 1907. Pp. xiii + 727.

It is likely that most writers will follow Bateson in using the broader term "genetics" for the subjects covered in this volume, rather than the older and more restricted term "thremmatology," proposed by Lankester, even if for no other reason than ease of pronunciation. However this may be, contemporary investigators seeking the facts of development, variation and heredity are fast accumulating vast quantities of data, past investigations are receiving renewed attention in the light of recent discoveries, and the author who undertakes the often thankless task of compiling a text-book from the varied lines upon which these subjects border, deserves the gratitude of all who are interested in the field. Dr. Davenport brings to his aid fifteen years' experience in presenting these matters in the class-room, and the result is a well-planned and logically developed treatise, written in such clear English that a college student should have little difficulty in seeing the matter with the author's eyes. It may be that all students of genetics will not accept his views upon disputed subjects, for they are the views of an ardent biometrician; it is positive that there will be a difference of opinion as to the relative importance of certain phases of the subject; yet this is the fate of all text-books, particularly those in a new field. There is hardly a doubt but that the statistical method of dealing with problems of heredity is unduly favored; and when the author asserts that "it is the only reliable method of attacking problems in transmission," cytologists and investigators using pedigree culture methods will lend their approbation only so far as to admit that a knowledge of the theory of statistics is a valuable *adjunct* to any line of work. On the other hand, the method of handling the

older debated questions of general biology—acquired characters, etc.,—is eminently fair and equitable.

The book is divided into four parts: in the first three, of increasing length, are discussed the kinds of variation, the causes of variation, and the transmission of characters, while the much shorter fourth part is devoted to practical problems. In a short appendix Dr. Rietz gives an excellent introduction to the theory of probabilities. Additional literature is cited at the end of each chapter, which, in the hands of a teacher familiar with all branches of the subject, would be a valuable basis from which to make selected lists for collateral reading. Unfortunately the classics cited are not distinguished from absolutely valueless articles, and such extended lists might thereby become rather more of a hindrance than a help. The originals are cited only when in English; the foreign work, which forms a large portion of the literature in genetics, is therefore noticed only in the form of English abstracts.

After an introductory chapter on the general nature of variability, variation is treated under the heads morphological, substantive, meristic, functional and mutational. The discussion under the first two heads, variations in size and quality, are quite short. We miss any consideration of the facts relating to the difference between mere bigness due to nutrition and inherited size due to gametic structure, which from its importance to the breeder we might reasonably expect. More extended treatment is given to the third type, the examples and text figures being drawn almost wholly from Bateson. Under functional or physiological variation, however, we are indebted to the author for a wealth of new illustrations, many of which are from experiments with beef and dairy cattle and with maize, that have never before been published. Under mutations the author gives to the reader the same impression (and the reviewer believes this time unintentionally) that has caused, and is still causing, false impressions among out and out Darwinians as to the true con-

ception of a mutation. All opponents and many adherents of de Vries seem to be able to conceive a mutation only as the addition or loss of a complete character and therefore a wide jump. That such a change sometimes takes place, the mutationist believes, and so also does the Darwinian (or at least so also did Darwin), but by far the larger number of mutations are quantitative changes in characters already possessed, *i. e.*, simply the production of new modes as centers for linear fluctuation. The difference between fluctuations and mutations is merely in their transmission.

Part II.—Causes of Variations—begins with an admirable non-technical description of cell division, followed by a development of the actual theme, in which are taken up first, internal causes which affect the individual, and second, those which affect the race. One can not help but be struck with the logical manner in which the author disposes of old, popular myths, such as telegony and intra-uterine influences, by appealing to the law of error. It is also gratifying to know that he has found by correspondence that practical breeders, for example dog fanciers, seem to be outgrowing their past childlike faith in these things. It is likely that this book will do much toward changing such superstitions as belief in maternal impressions in the next generation of animal breeders. Modern biometry as based on the theory of probability seems to the reviewer to have its greatest value to practical breeders in showing how illogical it is to consider isolated cases as proofs of a biological principle, and considerable emphasis is given by the author to this point. It is hardly likely that many present-day farmers will study thoroughly so bulky and technical a volume, although the author hopes to reach them, but their sons who have had some training in genetics in our agricultural colleges will be given a broader and more scientific point of view.

A large portion of the remainder of Part II. is devoted to external causes of variation. This portion is almost wholly an abstract of C. B. Davenport's "Experimental Morphol-

ogy." Then, as a transitory introduction to Part III, on "Transmission," follows a very judicial treatment of the inheritance of acquired characters. Here, again, the theory of probability is utilized to show that instances of apparent transmission of somatic modifications are, at least, doubtful—a judgment which the most ardent Lamarckian could hardly question.

A considerable percentage of the remainder of the part is devoted to pure biometry which the author believes to be the coming method for attacking genetic problems. The elements of biometry are explained with greater clearness than in any other English publication, and as such are to be highly recommended. The elaboration of the results of Karl Pearson and his school, however, shows too great a trust in Pearson's lame biology.

It will be exceedingly unfortunate if there is a promulgation of this idea of certain biometricians, namely, that valuable biological conclusions can be drawn where there have been no biological premises, by the mere fact of complex, mathematical treatment. As an example of a biometrical explanation which explains nothing the following may be cited (p. 537):

The principal function of selection, therefore, is to *alter the type, not to reduce variability*, and the facts here cited show the inherent impossibility of "fixing" the type in the sense that individuals will not depart from it. But, on the other hand, the same principle assures us that, however much we improve by shifting the type, there always remains sufficient variability for further selection, *and so long as variability remains there is hope and possibility for still further improvement.*<sup>1</sup>

Compare this view with that of Johannsen. (By the way, the epoch-making work of Johannsen on "pure lines" is not mentioned.) The latter considers the variation's curve of a quantitative character of any general population to be made up of numerous family lines. Members of these family lines are true to their own type, their fluctuations being due to nutrition, etc., and not inherited. The rôle of selection, therefore, is to isolate a family

<sup>1</sup>Last clause italicized by E. M. E.

line from a heterogeneous mixture of small types differing gametically among themselves. Here we have a real explanation compatible with the belief that to be inherited variations must have affected the germ cell structurally—a view to which the author apparently adheres.

Mendel's original investigations are briefly discussed by the author, but all of the numerous, recent contributions along this line are left untouched. Of course the immense amount of labor necessary to compile a book of seven hundred pages in a new subject would necessitate the work being actually behind the date of the preface, but one would like to see more notice taken of the many valuable investigations of contemporary biologists. A more extended consideration of late cytological and Mendelian research would have changed materially the author's treatment of atavism, prepotency and the determination of sex.

The work as a whole, however, brings together an enormous number of facts along diverse lines, and, though largely zoological, will undoubtedly prove of great value as a reference basis for a course of lectures on the subject, even if the new facts, which are continually being contributed in such profusion, make it of less value as an ironclad text-book.

EDWARD M. EAST

THE CONNECTICUT AGRICULTURAL  
EXPERIMENT STATION

*Mushrooms, Edible and Otherwise.* By M. E. HARD, M.A. Large octavo. Pp. xii + 609, with 504 half-tone figures from photographs, many of them full-page plates. Distributed by The Ohio Library Co., Columbus, Ohio.

Under the above title Mr. Hard has given us an exceedingly interesting and valuable book upon a subject in which every one is interested, whether he is a botanist or not. The book is intended primarily for the beginner and a chapter including such subjects as, Why Study Mushrooms? Mushrooms and Toadstools, How to Preserve Mushrooms, etc., and An Analytical Key, is written in words so simple and yet so accurate that even the beginning student will gain a ready hold

upon the group and will not be encumbered with a load of useless and unscientific data. As the late Dr. Kellerman states in the introduction, "The author does not write for the specially educated few, but for the mass of intelligent people—those who read and study, but who observe more." Thus the work is intended to appeal more especially to the people at large, but there is also much good in it for the college student of mycology. The generic and specific descriptions, and the great range of forms depicted in word and picture, are so nicely worked out that the book is one of the very best of the American publications of its kind. Without doubt this is the finest and most carefully arranged set of half-tone figures of American Agarics to be found in a single book.

A little more than one half (349 pages) of the book is devoted to the Agarics, the remainder being divided between the Polyporaceæ, Hydnaceæ, Pheleporaceæ, Clavariaceæ, Tremellini, Gasteromycetes, Ascomycetes, and a chapter each on the Myxomycetes, Recipes for Cooking Mushrooms, and How to Grow Mushrooms. These chapters are characterized by the same interesting style and excellent illustrations.

The author is determined that every one shall come to know mushrooms, first from the practical side to be able to identify the edible ones, and finally to know them from a more scientific standpoint, and then to be led to the broader study of mycology as a whole. The student of this book will unconsciously be led along this very path. As one turns the pages of the book he is delighted almost beyond expression, and he feels that Mr. Hard has rendered a great service to science in general and to mycology in particular in giving us this excellent work.

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#### SPECIAL ARTICLES

NOTES ON THE FIRST GENERATION HYBRID OF  
*OENOTHERA LATA* ♀ × *O. GIGAS* ♂

DURING the summer of 1907 three offspring of *Oenothera lata* ♀ × *O. gigas* ♂ were reared to maturity in the garden at the Station for